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The Classical Weekly

Entered as second-class matter November 18, 1907, at the Post Office, New York, N. Y., under the Act of Congress of March 3, 1879
Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on June 28, 1918

VOL. XIII

NEW YORK, OCTOBER 20, 1919

No. 3

ANALYSIS OF LUCRETIUS, DE RERUM NATURA I-III

(Continued from pages 5, 13)

14. The shapes of the atoms; the effects of the differences in the shapes of the atoms; the number of such shapes (333-580).
- (a) The atoms differ widely in shape (333-380).
- (1) Preliminary statement (333-337).
- (2) Proofs (338-380):
- (1') The fact that the total of the atoms is without limit and beyond count proves that the shapes of the atoms are very many (338-341).
- (2') The differentiation of genus from genus and the distinctiveness of individuals within the several genera prove that the shapes of the atoms are very many (342-376).
- (3) Summary and restatement (377-380).
- (b) The differences in the shapes of the atoms cause differences in the characteristics of the bodies made out of them (381-477). These include
- (1) differences in penetrating power. The bodies made up of the smaller atoms have the greater penetrating power; those made up of larger atoms or of atoms more decidedly hooked and hence interlocking have the lesser penetrating power (381-397).
- (2) differences in taste, as bitter or sweet (398-401); sweet things are made of smooth, round atoms (402-403), bitter things of rough, hooked atoms (404-405), that tear their way through our bodies (406-407).
- (3) all other possible differences in effects on our senses wrought by bodies (408-443).
- (1') Preliminary statement (408-409).
- (2') Applications (410-421): to sensations of sound (410-413), of smell (414-417), of sight, i. e. color (418-421).
- (3') Explanation of the differences in effects of bodies on sensation (422-433). A pleasant sensation is due to smoothness in the atoms (422-423), an unpleasant to roughness in the atoms (424-425). When an object merely tickles the senses, its atoms are neither smooth nor hooked, but rather have tiny angles that stand out but a little way (426-430). Some things—heat and cold—make their different impressions because their atoms are 'fanged' in different degrees (431-433).

(3'') Statement of an important principle: Sensation is always a matter of touch (434-441).

(a) Preliminary statement (434-435).

(β) Feeling through touch comes

(α') when something without the body works its way into the body (435-436); or

(β') when something innate in the body passes out of the body in a way to pain us (436), or in a way to give us pleasure (437); or

(γ') when atoms within our bodies, colliding, confound our power to feel (438-441).

(4') Summary (442-443).

Verses 434-441, though they flow naturally enough out of 433, are *per se* tangential; they are not a proof of the matter under discussion, but rather a note on the discussion. By the summary, more or less premature (see Note 7), in 442-443, Lucretius brings himself back to his proofs.

(4) other differences, e. g. of density (444-450), of fluidity (451-455). Again, some things are at once pungent and evanescent (456-463), whereas others are at once bitter (pungent) and liquid (464-477), because objects of the former class are made up in the main of atoms smooth and round, in part of atoms sharp, but not <hooked and> interlocking: hence they can puncture our senses but can not cling together; objects of the latter class are made up in part of atoms smooth and round, in part of atoms rough, though not hooked and interlocked.

(c) The number of different shapes of the atoms is not infinite (478-521).

(1) Preliminary statement (478-480).

(2) Proofs (481-521):

(1') The atoms are of limited bulk, invisible. If the varying shapes of the atoms were limitless in number, some atoms would be of unlimited bulk <and so visible> (481-482), since within so small a thing as one atom there cannot be many different shapes <here shapes = 'least': 483-485>. To illustrate: suppose that an atom consists of three 'least', and suppose that you shift these 'least' about, putting them into every possible combination; <the number of shapes you get will be limited>; to get more

shapes you must add more 'least's'. To get an infinite variety of shapes you must add 'least's' till you get an atom infinitely big! (486-499).

- (2') Further proof lies in the fact that there are definite, unvarying extremes beyond which our experiences of size, beauty, loathsomeness, etc., do not go (500-521),
 (a) in pleasurable ways—in color, smell, taste, sound (500-507);
 (β) in painful ways—in smell, sound, sight, taste (508-514);
 (γ) in temperature (515-521).
- (d) The number of atoms of any one shape is infinite (522-568).

(1) Preliminary statement (522-525).

(2) Proofs (525-564):

(1') Just because there is a limit to the number of different shapes of the atoms, the number of atoms of each shape must be unlimited: otherwise matter would not be infinite (525-531).

(2') Objection met and overthrown: *occu-patio* <see Note 14> (532-564).

(a) The fact that certain kinds of living things are, within our experience, rare does not disprove my argument, for there may be many specimens of them elsewhere, with resultant equalization of the total number of specimens (532-540).

(β) If some one thing is *sui generis*, its very birth, growth, and development would be impossible without a limitless supply of the kind of atoms that go to make it up (541-546), for, otherwise, there would not be enough of those atoms to meet; they could no more meet and form a definite thing than can the flotsam and jetsam that the sea tosses about after a shipwreck (551-564).

(3) Summary (565-568).

(e) Comment on the argument of 523-568 (569-580).

As a result of the factors brought out in our discussion <in 523-568>, neither the productive forces in nature nor the destructive forces are continuously superior (569-572); they have been waging war through all eternity, but it is a war in which the honors are even (572-574); now the one set of forces, now the other prevails, even as in man's experience birth and death alternate (575-580).

15. In every single thing there are many different kinds of atoms (581-699).

(a) Preliminary statement (581-588): In every object several sorts of atoms are mixed together (581-585); indeed, the more powers and capacities an object has, the more kinds of atoms, differently shaped, are combined within it to form it (586-588).

(b) Proofs (589-599, 661-699):

(1) The earth—one thing—contains elements that produce so many different things that the earth has been called Great Mother of Gods, Beasts, and Men (589-599).

(1') Digression: Interpretation of the myth of Cybele, and rejection of the myth as at variance with true reasoning (600-660).

(a) Statement of various details of the myth and an allegorical interpretation of them (600-617).

(β) Further details of the myth, told largely for their own sake (618-643).

(γ) Rejection of the myth (644-660).

(a') Preliminary statement: A fine scheme, this, but far removed from the truth (644-645).

(β') Proof (646-651):

(a'') The gods live a life of cloudless peace, far removed from us and our concerns (646-648).

(β'') They need us not; they have not feelings of love or anger toward us (649-651).

(γ'') Inference from the proof (652-658). <It is a waste of time, then, to call the sea Neptune or the earth Magna Mater, but> if a man wants to do so, let him, provided he does not really believe what his words seem to say.

(δ) Summary (658-660): The earth is non-sentient. It is, to be sure, in countless ways the source of life, but it is such source not because it is a sentient goddess, but because it contains within itself so many atoms of so many different kinds.

(2) The grasses and the waters of a given plain support animals as different as sheep, horses, horned cattle (661-668).

(3) The same grasses, the same waters give rise to things as different as bones, blood, veins, moisture, flesh, sinews (669-672).

(4) Bodies that are consumed by fire manifestly contain different sorts (shapes) of atoms—atoms of light, sparks, ashes (673-676).

(c) Summary: Everything contains within it atoms of different shapes (677-679).

(d) Further Proof <see Note 7>. Often one body is characterized by color, taste, smell, very different things, that affect our senses in quite different ways (680-685).

(e) Second Summary <see Note 7> (686-699). Atoms of quite different shapes, then, unite to form one body (686-687), even as many different letters unite to form one word (688-691). So atoms of the same shape are common to many objects, even as many letters are common to many words (688-696); yet the wholes made by these atoms <and others in the objects> are different (697-699).

(f) A warning against drawing an erroneous inference from 581-599, 661-699 (700-729).

(1) Preliminary Statement: Not all combinations are possible (700-701).

(2) Proofs (701-729).

(1') The fact that *portenta*, such as combinations of men and wild beasts (701-702), men from whose bodies branches grow (703), combinations of land creatures and sea creatures (704), or chimaeras (705-706), are not produced is proof that not all combinations are possible: things are born, in each case, of definite seeds, that is, of unvarying parentage, and in growing remain true to their kind (707-713).

(2') The phenomena of the growth of animals point to the same truth: some parts of food their bodies accept, some parts they reject (714-717).

Rejection is the important idea here.

(3') This law holds good also of inanimate objects (718-719). Since they differ widely in nature, they must be fashioned of atoms differing in shape (720-724); further, the intervals between these atoms, the paths they take in moving, the ways they are bound together, their weight, etc., must all differ one from another (725-729).

All this means that in the production of *res genitae* there is a process of selection and rejection of atoms, not universal acceptance of atoms.

16. The atoms are without color (730-841).

(a) Elaborate preliminary statement (730-738).

(b) Caution: Though the atoms are colorless, we can nevertheless apprehend them (739-748).

(1) Preliminary statement (739-740).

(2) Proofs (741-740):

(1') Men born blind recognize bodies by touch: hence we can, by imagination, recognize colorless atoms (741-745).

(2') We ourselves, in the dark, where in effect colors do not exist, recognize bodies by touch (746-748).

(c) Proofs of (a) (748-841):

(1) Since colors are constantly changing one into another, color can be no part of the atom, for, if the atom be not immutable, the world would come to naught (749-756).

(2) If, while denying color to the atoms, we give them different shapes <as we did above: see this Analysis, II, B, 14>, seeing in those shapes the sources of all the varied classes of objects, as of color itself, through the different arrangements of the atoms and their different movements (757-762), we shall easily explain how black objects suddenly become white (763-771).

(3) The view that the atoms have specific color(s) involves contradictions of the facts of experience: a sea fashioned of atoms of one color, say sea-blue, would always be of that one color, sea-blue; it would never be white

(772-775). The view that the sea is fashioned of atoms of different colors and yet remains one single brightness, as a rectangle is made up of varied other shapes and yet remains one shape, is even more absurd, for, though in the rectangle we see the other shapes, we do not mark in the sea different colors <at any one time> (780-783). Indeed, this view involves a contradiction in terms, since there is no such thing as a single brightness fashioned out of varied colors (784-787).

(4) If we are moved to assign color to the atoms in the thought that white things come from white sources (788-789), let us note that the assumption which leads to this conclusion is itself unfounded, for white things are not born of white things; indeed, they come more readily from colorless things than from black or from any other definite color (790-794).

(5) Since light is essential to color and since the atoms do not come into the light (because they are invisible), they are colorless (795-816).

(1') Preliminary statement (795-798).

Attached to this is an elaboration, finely poetic, but logically needless, of the doctrine of 795, that light is essential to color (799-807).

(2') Variations of color, such as those spoken of in 799-807, are due to blows of light (808-809); our perception of color(s) is due to blows on the pupil of the eye (810-812), blows which spring not from the colors of objects but from the shapes of their atoms (813-814).

(3') Summary: The atoms are colorless <but of divers shapes> (815-816).

(6) The persistence of specific colors in specific genera proves that the atoms are colorless, for, since color and shape have no necessary connection each with the other, it follows that, if the atoms had color(s) of their own, we should find such things as white crows and black swans (817-825).

(7) Since, as one makes an object smaller and smaller, its color vanishes more and more, it follows that the <invisible> atoms can have no color at all (826-833).

(8) Argument by analogy. As some things are, plainly, without sound or odor, we infer that some things are without color (834-841).

17. The atoms lack also heat, cold, sound, taste, smell (842-864).

(a) Preliminary statement (842-846).

(b) Proof (847-864). When one essays to make e. g. oil of myrrh, he seeks a scentless oil, one which shall as little as possible affect the mixture he is making (847-853); so, that the *res genitae* may be of the proper nature, the atoms themselves must be tasteless, soundless, etc. (854-859). All such characteristics are perishable: hence they have nothing to do with the atoms. If they had, the atoms would be perishable, and the world would come to nothing (859-864).

18. The atoms, again, lack sense (are insensate): yet out of the atoms are fashioned all things that have sense (are sensible) (865-990).

(a) Preliminary statement (865-870).

(b) Proofs (871-990):

(1) In certain cases we actually *see* the sensible created out of the senseless—e. g. worms from filth (871-873). We see, constantly, senseless things transformed into sensible things—e. g. water, leaves, pasturage into cattle (874-878). In fact, nature transforms all kinds of food into living, sensible bodies, and out of food produces all the senses of animate creatures (879-882), as the result of different arrangements of the atoms and their different movements (883-885).

(2) Example of *occupatio* <see Note 14> (886-930).

(1') Objection stated: The theory under review is, to be sure, hard to believe, because stones, wood, earth do not normally, even when mixed, produce sense (886-890).

(2') Answer to the objection (891-901).

(a) Please note what I really said: I grant that not all object-producing forces beget sense (891-893); important factors in the production of sense are the size of the atoms (894), their shape (895), their movements, and their arrangements (896).

(β) Though we cannot see *how*, under certain conditions, lumps of earth and logs produce worms, still they do produce them, because through the entrance into them of new atoms the former arrangement of their substance is altered (897-901).

(γ) To make, as some do, the seeds of what is sensible (i. e. the atoms) themselves sensible is to make the atoms soft and so perishable (902-904), since sensation is linked always with flesh, sinews, veins, all soft and mortal things (904-906).

(δ) An elaborate 'dilemma' (907-930):

(a') Supposition: Suppose that the sources (seeds) of sensation were at once sensible and immortal (907).

(β') Statement of the consequences of the supposition (908-909). They must then <theoretically>

(a'') either have the sense of a part only of a sentient creature; or

(β'') precisely the same sense as a whole living creature has

(γ') Answer to (a'') (910-926), in two parts.

Part 1: In point of fact, a part cannot feel by itself: e. g. a hand severed from a body cannot feel (910-913).

Part 2, itself in the form of a 'dilemma' (914-926):

(a'') If the seeds feel as we feel [i. e. if the seeds of which we are talking have precisely the same sense as a whole living creature has (914-916)], then, on the one hand, <if always, into whatever combinations they enter, they keep their sense>, either it will no longer be possible to call them *primordia*, since, as sensible things, they will be mortal (917-919); or if we allow the atoms to be at once sensible and immortal, then, through the union and combination of different sorts of atoms³², every one of them sensible, there would result only strange and monstrous sentient creatures (920-921), as monstrous as would result from the combination of men, cattle, and wild animals (922-923).

(β'') On the other hand, if, <as they enter into combinations>, they lose their original sense, and gain another, it was useless for them to have that sense at first (924-926).

(δ') Summary, framed, however, as if it were a new argument: Sensation can be begotten of that which is not sensation (926-930).

(ε) Another example of *occupatio* (931-972).

(a') Objection stated: Sensation can be developed out of non-sensation by a 'change' <of the atoms> or by a kind of 'birth' <of the atoms> (931-933).

Lucretius writes very vaguely here. Those whose view he is opposing seem to have held that, though the atoms, when isolated, were non-sentient, they underwent a change, when they entered into a combination, as the result of which they became sentient, and so were in a sense 'born'.

(β') Answer to the objection (934-972).

Birth implies (previous) union: so too does change (934-936). Until there is a union of the atoms (a birth, yes, but a birth of a *res genita*, not of the atoms), there can be no sensation at all, because, prior to such union in a *res genita*, the atoms, non-sentient, are scattered in air, water, etc., and have not yet met, and so have not entered into those movements which alone beget sense (937-943). That sensation is due to the union of the atoms, not to the atoms *per se*, is clear from the fact that a blow too heavy for a given thing takes away from it sensation (944-946), manifestly because the blow changes the arrangement of the atoms and alters

³²We must keep in mind here, as Lucretius did, his demonstration (see this Analysis, II, A, 15), that there are divers kinds of atoms in each *res genita*.

their movement, in a word dissolves their union (947-953). Recovery from a blow means that the union, though disarranged for a time, is restored (954-962). Again, the phenomena of pleasure and pain show that sensation is due to the union of the atoms, not to the atoms *per se*. Pain is due to the disturbance of the union of the atoms (963-965), pleasure to a resumption of the *status quo ante*, that is, these sensations are due to movements of groups of atoms (966). The isolated, individual atoms can experience neither pleasure nor pain (967-972).

- (γ) The assumption that the atoms *per se* have sense leads to wildly absurd results, e. g. to the conclusion that the atoms of human beings laugh and cry and think, yes, even think about atoms! (973-990).
(To be concluded) C. K.

REVIEWS

Social and Private Life at Rome in the Time of Plautus and Terence. By Georgia Williams Leffingwell. (Volume XXXI, No. 1, of the Columbia Studies in History, Economics, and Public Law). New York: Columbia University Press (Longmans, Green and Co., Agents: 1918). Pp. 137.

This doctoral dissertation was written under the direction of the Department of History. The subject was suggested by the late Professor Botsford, the work was apparently partly done during his lifetime, and the book is dedicated to his memory. It consists of an Introduction; eight Chapters, entitled respectively Dwelling (Town and Country), Women and Marriage, Children and Education, Slaves, Freedmen and Clients, Finance and Industry, Religion, Morals and Character; and Bibliography. It is well written in clear and readable English¹.

Miss Leffingwell states it to be her purpose to assemble as far as possible the source evidence on social and private life during the first half of the second century B.C., and from this evidence to draw certain conclusions which will give a clearer understanding of the habits of thought and the feelings of the average citizen of the time.

If the author had adhered to the first part of her purpose, she would have produced a very useful book, but even her own material is not completely cited, as she herself informs us (page 19), "Frequently . . . all the references which have been found on a given point are not mentioned", but she hopes that "enough are cited to be significant and . . . conclusive". In a work of this kind lack of completeness in the material is a serious detriment, for the process of inference—the second part of Miss Leffingwell's purpose—is so difficult

that one needs all the facts upon which such inference can be based. If the inclusion of all her material would have made the book too large, it would have been better to restrict the number of the topics and give the full material for those selected. In fact the scope of the work is too ambitious for most candidates for the degree of Ph.D.; the topic of slaves alone, for example, is an ample subject for a dissertation.

The difficulty of the task which Miss Leffingwell has undertaken is sufficiently indicated by the fact that the work of a century on different parts of it has failed to produce results which are in general satisfactory to scholars. In 1811 the University of Copenhagen offered a prize for a study which should determine what is Roman and what is Greek in the dramatic methods of Plautus and Terence, and in 1912 Freidrich Leo asserted that the topics of law, of military, domestic, city, and country life, and others like them, require new investigation with a view to the separation of the Roman and the Greek elements (Plautinische Forschungen², 112). Professor Leo gives some hints as to methods which may lead to better results.

This central difficulty—disentangling the mixture of Greek and Roman elements in Plautus and Terence—is recognized by Miss Leffingwell, and she devotes most of her Introduction to a discussion of it, aiming her remarks chiefly at Sellar and Legrand, who consider the plays so essentially Greek in content that they are of little value as a basis for inferences about Roman life. This extreme view hardly requires refutation; indeed it is the chief fault of Legrand's painstaking and valuable book³ that he assumes far too much in Plautus to be Greek. But Miss Leffingwell argues herself into the other extreme, for we read (18),

It may be assumed, therefore, that the majority of the habits and allusions contained in the comedies are either conclusively Roman, Roman with Greek antecedents, or Greek customs already introduced into Rome and familiar to the Romans.

Thus the author assumes at the outset the very point which should be proved in every case by investigation of her material before she draws from that material inferences about Roman life. Even if her argument in support of the foregoing assumption were sound, she errs in considering it valid for the "majority of habits and allusions", since even in accordance with this form of stating the case there is a residue of phenomena for which the assumption is not valid. But the fact is that no such blanket principle can be assumed. The groups of phenomena differ widely, and each group may involve and often does involve a different mixture of Greek and Roman elements; e. g. the license of the slaves seems Greek, but in the matter of food Italian pork products play a large part. Or take the titles praetor, aedilis,

²Miss Leffingwell consistently spells "Legrande", and she refers to the French classicist's work as "*Matière de la comédie nouvelle*". This is merely the title of the first part of his book *Daos. Tableau de la Comédie Grecque pendant la période dite Nouvelle* (*Κωμῳδία Νέα*), Lyons, 1910, which Mr. James Loeb has translated in condensed form as *The New Greek Comedy* (1917).

¹There are, however, a good many annoying misprints and small errors, e. g. *nulrex* (for *nulrix*) repeatedly.